APPENDIX E

North Baja Pipeline Submittal to FERC Regarding Air Quality Impacts

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FEDERAL ENERGY
REGULATORY COMMISSION

November 13, 2001

INFORMATION HAS BEEN REMOVED FOR PRIVILEGED TREATMENT

David P. Boergers, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Re: *North Baja Pipeline, LLC*, Docket Nos. CP01-22-000 and CP01-23-000

Dear Mr. Boergers:

North Baja Pipeline, LLC ("North Baja") hereby submits for filing its Responses to DEIS/DEIR Conditions 10, 11, 15, 17, 18 and 19. North Baja also submits certain supplemental information concerning the East Side Alternative, the Spill Prevention, Containment and Control Plan and Air Quality regarding emissions from Mexican plants.

Certain of the Responses to DEIS/DEIR Conditions contain cultural resources information. Thus, North Baja seeks privileged treatment for such information pursuant to 18 C.F.R. §§ 380.12(f)(4) and 388.112. North Baja encloses a complete original of the filing and seven (7) copies of the filing without the information for which privileged treatment is sought.

If you have any questions regarding this matter, please contact the undersigned.

Sincerely,

Carl M. Fink

NBP Supplemental Filing
November 12, 2001

Air Quality Information regarding Emissions from Mexican Power Plants, including:

1. **NET emissions change in the Mexicali area due to the construction/modification of the power plants associated with NBP**
2. **Total emissions from the two generating units at the Intergen facility that will supply power to Mexico**
3. **Appropriate identification for the two Intergen units that will supply power to Mexico**
4. **Response to American Lung Association Comments from Sempra Energy Affiliate Termoelectrica De Mexicali**

B.5.a.

Emission impacts in Mexicali/ Imperial Valley

To determine the NET emission change in the Mexicali area we must consider the impacts with and without construction of the N Baja pipeline. The emissions associated with the Sempra and Intergen power plants proposed for the Mexicali area are shown in the table below.

Emission Source	NO_x, TPY	SO_2, TPY	Particulate, TPY	CO, TPY	Data Source
Sempra "Termoelectrica de Mexicali"	189	NA	238	188	1, 2
Intergen "La Rosita"	323	NA	428	1,458	3, 4, 5
Intergen "Energia de Baja California"	1,584	NA	428	486	6, 7
Total	2,096	NA	1,094	2,132	

Data Sources and notes:

1 NO_x and CO from Imperial County APCD letter to DOE dated September 26, 2001 (Table 1).
2 PM_{10} from Table A-1 of Environmental Assessment (EA) based on emission rate of 12.3 kg/hr used as modeling input for each of two units.
3 NO_x from Table B-2 of EA based on emission rate of 3.1 grams/second used as modeling input for each of three units.
4 CO from Imperial County APCD letter to DOE dated September 26, 2001 (Table 1).
5 PM_{10} determined from Table B-2 of EA based on emission rate of 6.17 grams/second used as modeling input.
6 NO_x and CO from Imperial County APCD letter to DOE dated September 26, 2001 (text of letter states that total Intergen NO_x emissions would be 1,907 TPY for both facilities).
7 PM_{10} estimated based on worse case assumption that emissions would same as La Rosita (see data source 1).
8 No information on SO_2 emissions were available. We would expect natural gas-fired emissions to be very low.
9 Information provided by Intergen indicates some differences with the table above, both in total emissions and which emissions come from which plants. Intergen's estimates are:

Emission Source	NOx, TPY	SO_2, TPY	Particulate TPY	CO, TPY
"La Rosita"	1654	NA	500	1435
"Energia de Baja California"	131	NA	244	445

If the N Baja pipeline were not constructed, the demand for power would still exist in the Mexicali area and it is reasonable to assume that power plants would be built firing heavy oil or diesel. For the sake of conservatism, we will assume

only one 500 MW, diesel fired combined cycle plant with H_20 injection to control NOx, would be built to serve the Mexican load contracted by CFE . (It is highly likely that other plants would also be built since two are already under construction. This is meant only to be a conservative assumption.)

The estimated emissions associated with that single plant would be:

Emission Source	NOx, TPY	SO2, TPY	Particulate TPY	CO, TPY
500 MW Diesel Combined Cycle	4100	8626	205	1298

These were calculated using EPA's AP-42 emission factors for diesel fired turbines with H2O injection. These factors are: NOx—0.24 lb/mmbtu; CO—0.076 lb/mmbtu; SO2—0.505 lb/mmbtu and PM10—0.012lb/mmbtu. The calculations were also based on an estimated heat rate of 7,800 btu/kwh, an annual heat input of 34,164,000 mmBtu/yr and an assumed diesel fuel sulfur content of 0.5%. (Typical diesel fuel in Mexico tends to be closer to 1%, so this is a conservative assumption.)

Based on these assumptions, the NET emissions impact with the construction of N Baja pipeline in the Imperial County/ Mexicali area would be:

	NOx, TPY	SO_2, TPY	Particulate TPY	CO, TPY
Change in total emissions	-2,004	-8,668	889	834

The reduction in total emissions in the region as a result of the N Baja project would be over 8,900 tons per year.

Emission Impacts in Rosarito/ Tijuana/ San Diego County

To look at the impacts of the entire N Baja project, one must also look at what happens in the Rosarito/ Tijuana/ San Diego area. Without the N Baja project, the existing power plants at Rosarito, and the power plants in San Diego, will be subject to increasing curtailments due to inadequate capacity on the SoCal Gas/ SDG&E gas transmission systems. Curtailments of these power plants have already occurred, before several plants at Rosarito had converted from oil only to gas burn capability. As San Diego continues to grow, and as the power plants under development in San Diego come on line and start to consume gas, the situation will get worse. (In fact, the local Air Pollution Control District has testified before the California CPUC in a proceeding on the adequacy of the gas transmission system in San Diego, that they are concerned there will be inadequate pipeline capacity for San Diego even if the North Baja Pipeline is built.)

If one assumes conservatively that only the fuel switching capable plants at Rosarito are curtailed (i.e. existing and future plants in San Diego are not

curtailed, and the new 550 MW combined cycle plant at Rosarito is not curtailed) and that curtailment requiring fuel switching happens only 30% of the time, the following emissions would occur from those plants during the time they were burning oil.

Emission Source	NOx,TPY	SO_2,TPY	Particulate TPY	CO, TPY
Rosarito Plant boilers burning oil	1,575	7,889	620	168
Rosarito Plant CT burning diesel	2,904	1,667	40	11
Total	4,479	9,556	660	179

With the North Baja pipeline in service, there would be no curtailment to these plants and they would burn gas instead of oil during these periods. The emissions that would occur burning gas are shown in the table below.

Emission Source	NOx,TPY	SO2,TPY	Particulate TPY	CO, TPY
Rosarito Plant boilers burning gas	940	3	38	416
Rosarito Plant CT burning gas	1060	2	22	272
Total	2000	5	60	688

These emissions estimates are based on the following Rosarito operating information and assumptions and the following EPA AP-42 boiler and combustion turbine emission factors.

Rosarito Operating Information and Assumptions

Boilers	320 MW	
Combustion Turbines(CT)	180 MW	
Fuel Sulfur, %	1.5	(This is a conservative estimate. Typical fuel sulfur content in the region is closer to 2.0%.)
Boiler Heat Rate, Btu/KWR	12,000	Typical of plant built in the 1960's
Simple Cycle CT Heat Rate, Btu/kwhr	14,000	Typical of simple cycle CT
Fuel Oil Heat content, Btu/gallon	150,000	Taken from AP-42
Fuel Oil burned in boiler, gallons/year	67,000,000	
Diesel burned in CT, gallons/year	44,000,000	
Natural gas burned in boiler, $mmft^3$/year	9,894	
Natural gas burned in CE, $mmft^3$/yr	6,493	

EPA AP-42 Factors used for analysis

Pollutant	AP-42 Boiler Emission Factors		AP-42 Combustion Turbine Emission Factors	
	Fuel oil, lb/1000 gal	Natural Gas, $lb/mmft^3$	Diesel, lb/mmBtu	Natural Gas, lb/mmBtu
NO_x	47.0	190	0.88	0.32
CO	5.0	84	0.0033	0.082
SO_2	235.S	0.6	0.505	0.0006
PM_{10}	18.5	7.6	0.012	0.0066

The Net Impact in the Rosarito/ Tijuana/ San Diego region would be:

	NOx, TPY	SO_2, TPY	Particulate, TPY	CO, TPY
Change in total emissions	-2479	-9551	-600	509

The reduction in total tons of emissions in this region as a result of the N Baja project would be over 12,000 tons per year.

Total North Baja emission impacts

The overall combined impact in the San Diego/ Rosarito/ Imperial Valley/ Mexicali trans-border region with construction of the N Baja pipeline would be:

	NOx, TPY	SO_2, TPY	Particulate TPY	CO, TPY
Change in total emissions	-4,483	-18,177	289	1,342

The total reduction in emissions in the entire trans border region from the North Baja project would be over 21,000 tons per year.

B.5.b.

Refer to the emissions in the table above.

B.5.c.

The original Intergen project, known as Energia Azteca X or "La Rosita", was a 750 MW facility with 500 MW dedicated to serving CFE and 250 MW for export. Intergen later added a new 250 MW project for export at the same site that is known as Energia de Baja California. Energia de Mexicali was a proposed project that never signed a Precedent Agreement with North Baja, and to our knowledge has ceased development efforts.

Termoeléctrica De Mexicali

Octávio Simões
Director

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October 16, 2001

Ms. Jan Cortez, Vice President, Research and Environmental Health
Ms. Susanna Concha Garcia, Environmental Health Coordinator
American Lung Association of San Diego and Imperial Counties
2750 Fourth Avenue
San Diego, CA 92103

Dear Jan and Susanna:

We would like to thank you for the opportunity afforded to us on September 28th to meet. The primary purpose of this meeting was to address the concerns of the American Lung Association ('ALA') and clear up misinformation regarding Sempra Energy's power plant project in Mexicali. One of the action items we had from this meeting was to provide a written response to the letter sent by ALA to Presidents Bush and Fox on September 5, 2001.
In the referenced letter, nine points are presented regarding the direction that the ALA would like to see taken when power plants are developed in the border region. As a sponsor of one of the new power plants being developed in the region, specifically, the 600 MW Termoeléctrica De Mexicali ('TDM') project in Mexicali, we would like to address those nine points.

1. ***That all new power plants built along the Mexico-USA border should meet simultaneously with Mexican and US air emission standards for NO_x, CO, VOCs, $SO_{2,}$, PM_{10} and ammonia.***

TDM is voluntarily complying with this requirement. TDM is not only meeting all the Mexican law requirements, but also installing the exact same equipment being required of plants that have been most recently licensed in California and Arizona. Specifically, dry low NOx combustors and Selective Catalytic Reduction for NO_x control to a level of 2.5 ppm @15% O_2 and oxidizing catalyst for CO control to a level of 4 ppm @15% O_2. All other levels of emissions for the TDM project are the same as those most recently permitted projects in the United States.

2. ***Install continuous emission monitors and share the data with authorities on both sides of the border on a regular basis.***

TDM is voluntarily complying with this requirement. In May of 2001, TDM sent the Imperial County Board of Supervisors a written proposal wherein TDM committed to install and operate continuous emission monitors at the power plant, share the data with the Imperial County Air Pollution Control District ('ICAPCD'), and allow access to the plant by officials of Imperial County. We are disappointed that we have not received any feedback from the Imperial Valley

on that proposal to date. That notwithstanding, we will proceed with the installation, operation and sharing of this information with interested parties.

3. ***That air pollution offsets be required to match the new pollution generated from power plants on a ton for ton basis.***

The Mexican government, like many others around the world, does not recognize the emission offsets concept.. Furthermore, even in the United States, not all air contaminants are required to be "offset". Only those pollutants that are considered to be in non-attainment or are precursors to non-attainment air contaminants are required to be offset. For example, CO emissions are rarely required to be offset (this is the case even in many areas considered to be in non-attainment for CO). The position adopted by TDM from the beginning was to build the cleanest plant possible instead of building a plant that complied solely with Mexican law and mitigate the higher emissions with offsets. Additionally, TDM has discussed this issue with the ICAPCD. During those conversations, it was clear that their preference was to build the cleanest plant possible. This approach is significantly more expensive to the project when compared to not installing additional emission controls, meeting Mexican regulatory requirements only, and seeking emission offsets from Mexican sources for the higher emission rate. It is also interesting to note that one of TDM's affiliate companies is the owner of the gas distribution company in Mexicali - ECOGAS. Based on the actual conversion of existing customers from fuel and diesel oil to natural gas, we have calculated the reductions in emissions achieved from the conversions to natural gas of ECOGAS customers. The results show annual estimated reductions in excess of 250 tons of NO_x, 75 tons of PM_{10}, and 2,450 tons of SO_2. These NOx and PM_{10} and PM_{10} precursor reductions would be more than enough to "offset" TDM's emissions. The calculation is attached for your reference.

4. ***To fund Sustainable Development Projects as mitigation for air pollution generated by power plants.***

TDM is building a US $20 million water treatment plant to help Mexicali deal with a critical environmental problem. The existing sewage treatment plant cannot handle Mexicali's sewage treatment needs, which results in sewage being discharged to local water bodies. Furthermore, the existing sewage treatment facility provides primary treatment before discharging. TDM's sewage treatment facility will provide secondary and tertiary water treatment to the water that will be used by the project. TDM has also sought proposals from the Imperial County Board of Supervisors to address projects that can benefit the environment in Imperial County. This approach is consistent with the approach that our company takes when developing generation anywhere in the world.

5. ***Air-monitoring stations located in Mexicali and Calexico should be fully functional.***

TDM agrees that ensuring fully functional air monitoring stations is very important in providing documentation of existing air quality and future changes to air quality. However, the responsibility for ensuring that the stations are functional lies with the pertinent country agencies and is not a function that canbe undertaken by individual entities.

6. That power plant companies put in writing that they will burn only natural gas, unless an emergency condition occurs.

TDM is voluntarily complying with this requirement. TDM is designed and being built to burn only gas. TDM's permit application states that it will burn natural gas only.

7. Mexico to adopt new regulations for the border area to require facilities to employ the best available control technology for air emissions.

TDM is voluntarily complying with this requirement. Whether Mexico adopts this requirement or not is an issue that TDM has no control over; however, if Mexico were to adopt this requirement, no modifications would be required at TDM.

8. California to create legislation that requires all power plants exporting electricity to the state to meet California Air Quality Emission Standards for air emissions.

TDM is voluntarily complying with this requirement. Whether California adopts this requirement or not is an issue that TDM has no control over; however, if California were to adopt this requirement, no modifications would be required at TDM.
For clarification, we assume that the ALA is proposing to impose this requirement on all the plants exporting power to California, whether they are located in Mexico, Canada, or any of the neighboring states.

9. Both countries to support alternative methods of energy production, reduce energy demand, and support efficient use of energy.

We agree. TDM and its affiliated companies have one of the strongest records in supporting these principles. At our El Dorado Energy facility, Sempra Energy Resources owns approximately 200 kw of solar powered electrical generation facilities. We are continually evaluating other alternative methods of energy production and retain an open mind to their use.

As documented above, we share your concerns and have implemented the TDM project in a way that meets all the points suggested in the ALA letter, especially those that TDM can address directly. We believe that TDM is leading the way as a model for the environmentally responsible development of power plants in the border region. Since TDM is meeting all the ALA requirements, we would like to take this opportunity to ask for your public support of our project.

During our meeting, we also discussed the North Baja pipeline that is being developed by one of our affiliates. The pipeline will bring natural gas to Baja California and to San Diego. This is the first major source of clean fuel supply to the region in years. As the regional economy continues to grow, the demand for energy will increase. If natural gas is not available, the alternative is likely to be oil, especially in Mexico. Supporting the pipeline development will yield a significant improvement in air quality to both Mexico and the United States, as the emissions from oil will be significantly higher than emissions from gas. We have also included a calculation that

illustrates this point. Given the tangible benefits to air quality for the region, we would also like to request that the ALA consider publicly supporting the execution of the pipeline project.

Please call us if you have any questions or comments. Thank you,

Very truly yours,

Octavio Simões, Director

cc:
M. Nelson
K. Prasser

YEAR 2000

CALCULATION OF EMISSION REDUCTIONS IN MEXICALI ACHIEVED BY SEMPRA ENERGY

Actual Emission Reductions in Mexicali Resulting from Sempra Energy Natural Gas Sales in Year 2000

Background

- Sempra Energy's local natural gas distribution company in Mexicali, ECOGAS, has approximately 11,700 residential and industrial customers.
  - Approximately 140 of these are commercial customers.
- Prior to ECOGAS's existance, all current ECOGAS customers used either propane, fuel oil #6 or fuel oil #2.
  - Residential customers used propane.
  - Industrial customers used propane, fuel oil #6 and, to a lesser extent, fuel oil #2.
  - Industrial customers include Sidek, a steel manufacturing facility; San Francisco, a paper mill; Fabrica de Envases de Vidrio, a glass manufacturing facility; VITRO, also a glass manufacturing facility; Zahary, an asphalt roof shingle manufacturer, and others.
  - The fuel consuming equipment at these sources consists of external combustion sources such as boilers and combustion ovens.
- In the year 2000, Ecogas supplied a total of 3,977,456 MMBtu of natural gas in Mexicali.
  - 69,440 MMBtu was consumed by residential customers.
  - 3,908,016 MMBtu was consumed by industrial sources.
    - 1,406,886 MMBtu was consumed by industrial sources previously utilizing propane.
    - 2,501,130 MMBtu was consumed by industrial sources previously utilizing fuel oil #6 and fuel oil #2.
      - 2,346,810 MMBtu displaced fuel oil #6 usage
      - 154,320 MMBtu displaced diesel oil #2 usage

2000 Mexicali Natural Gas Sales by Sector and Fuel Displaced

		Fuel Displaced	MMBtu
1	Total natural gas usage – Mexicali	Propane, fuel oil #6 and fuel oil #2	3,977,456
2	Residential customers	Propane	69,440
3	Industrial customers	Propane, fuel oil #6 and fuel oil #2.	3,908,016
4	Industrials firing fuel oil	Fuel oil #6 and fuel oil #2	2,501,130
5	Industrials firing fuel oil #6	Fuel oil #6	2,346,810
6	Industrials firing fuel oil #2	Fuel oil #2	154,320

YEAR 2000 EMISSIONS REDUCED IN MEXICALI BY SEMPRA ENERGY NATURAL GAS SALES

Based on the numbers above and the assumptions detailed below, the amount of emissions reduced as a result of the year 2000 sales of natural gas in Mexicali by Sempra Energy can be calculated.

Given:

- 2,346,810 MMBtu of fuel oil #6 usage from industrial sources was displaced in 2000.
- 154,320 MMBtu of fuel oil #2 usage from industrial sources was displaced in 2000.

Assumptions:

- EPA AP-42 emission factors are applicable.
- All of the fuel oil displaced was consumed by external combustion sources, consisting of boilers < 100 MMBtu/hr of heat input.
- Emission factors for fuel oil are from AP-42, Chapter 1.3 – Fuel Oil Combustion, Table 1.3-1.
  - ⇨ Fuel oil #6:
    AP-42 emission factors:
    - NOx – 55 lb/1000 gal
    - PM – 10 lb/1000 gal
    - SO_2 – 157S lb/1000 gal
  - ⇨ Fuel Oil #2
    AP-42 emission factors
    - NOx – 20 lb/1000 gal
    - PM – 2 lb/1000 gal
    - SO_2 – 142S lb/1000 gal
- Emission factors for natural gas are from AP-42, Chapter 1.4 – Natural Gas Combustion, Table 1.4-1 and Table 1.4-2; note that sulfur content is unspecified in AP-42, therefore, assume 2000 grains/MMcf.
  - ⇨ Natural Gas
    AP-42 emission factors
    - NOx – 100 lb/MMcf
    - PM – 1.9 lb/MMcf
    - SO_2 – 2000 grains/MMcf
- Fuel oil #6 heating content = 150 MMBtu/1000 gal (see AP-42, page 1.3-8)
- Fuel oil #2 heating content = 140 MMBtu/1000 gal (see AP-42, page 1.3-8)
- Fuel oil #6 sulfur content = 2% by weight
- Fuel oil #2 sulfur content = 0.05% by weight
- Assume natural gas heating content of 1035 Btu/cf

Calculations:

1. Convert natural gas consumed to liquid fuel equivalent on a BTU basis:

   Fuel oil #6: (2,346,810 MMBtu)(1/150 MMBtu/1000 gal) = 15,645,400 gallons

   Fuel oil #2: (154,320 MMBtu)(1/140 MMBtu/1000 gal) = 1,102,286 gallons

   This represents the amount of fuel oil displaced by natural gas sales.

2. Calculate the amount of emissions that would have been generated in 2000 if natural gas sales had been in liquid fuel form:

   Fuel Oil #6:

NOx:	(55 lb/1000 gal)(15,645,400 gallons) =	860,497 lb NOx
PM:	(10 lb/1000 gal)(15,645,400 gallons) =	156,454 lb PM
SO_2:	(157 lb/1000gal)(2)(15,645,400 gallons) =	4,912,656 lb SO_2

   Fuel Oil #2:

NOx:	(20 lb/1000 gal)(1,102,286 gallons) =	22,046 lb NOx
PM:	(2 lb/1000 gal)(1,102,286 gallons) =	2,205 lb PM
SO_2:	(142 lb/1000 gal)(0.05)(1,102,286 gallons) =	7,828 lb SO_2

   Total Displaced Fuel Oil Emissions Avoided in 2000 by Natural Gas Sales:

	Fuel Oil #6 (lb)	Fuel Oil #2 (lb)	Total (lb)	Total Fuel Oil Fired Emissions (TPY)
NOx:	860,497	22,046	882,543	441
PM:	156,454	2,202	158,656	79
SO_2:	4,912,656	7,828	4,920,482	2,460
Totals:	5,929,607	32,074	5,961,681	2,981

3. In order to calculate NET emissions displaced, the amount of natural gas emissions have to calculated:

   Convert the amount of MMBtu's of natural gas consumed to cubic feet:

   - As noted, 3,908,016 MMBtu was consumed by industrial sources, assuming 1035 Btu/cf:

     (3,908,016 MMBtu)(1/1035 Btu/cf) = 3,776 MMcf in 2000

4. Calculate amount of emissions generated by natural gas fuel usage in 2000:

NOx:	(100 lb/MMcf)(3776 MMcf) =	377,600 lb NOx
PM:	(1.9 lb/MMcf)(3776 MMcf) =	7,174 lb PM
SO_2:	(2000 gr/MMcf)(1 lb/7000 gr)(3776 MMcf) =	1,079 lb SO_2

Total Natural Gas Fired Emissions in 2000:

	Total Natural Gas Fired Emissions (lb)	Total Natural Gas Fired Emissions (TPY)
NOx:	377,600	189
PM:	7,174	4
SO_2:	1,079	0.5

5. Net emissions reduction, therefore, is the difference between the displaced fuel oil emissions (item 2) and the natural gas fired emissions (item 4) above:

YEAR 2000 NET EMISSION REDUCTIONS DUE TO NATURAL GAS SALES IN MEXICALI BY SEMPRA ENERGY

	Oil Fired Emissions (TPY)	Natural Gas Fired Emissions (TPY)	Net Emissions Reduction (TPY)
NOx:	441	189	252
PM:	79	4	75
SO_2:	2460	0.5	2460
Total:	2980	194	2787

CONCLUSIONS

- Sempra Energy's natural gas distribution company in Mexicali, ECOGAS, supplies natural gas to residential and industrial customers in Mexicali.
- In the Year 2000, ECOGAS sold 3,977,456 MMBtu's of natural gas in Mexicali.
- Sempra Energy's natural gas sales in Mexicali resulted in the displacement of 2,885,913 of fuel oil usage in Mexicali from industrial sources.
- This displacement of fuel oil usage has resulted in a net reduction of 2785 tons of total emissions in the year 2000, consisting of 252 tons of NOx, an ozone precursor, 75 tons of PM and 2458 tons of SO_2, a PM precursor.

CALCULATION OF EMISSION REDUCTIONS IN BAJA CALIFORNIA NATURAL GAS PIPELINE VS. FEASIBLE ALTERNATIVES

COMPARISON OF NATURAL GAS AND OIL FIRED EMISSIONS

Assumptions

- EPA AP-42 emission factors are applicable.
- All of the fuel oil and natural gas is consumed by external combustion sources, consisting of boilers < 100 MMBtu/hr of heat input.
- Emission factors for fuel oil are from AP-42, Chapter 1.3 – Fuel Oil Combustion, Table 1.3-1.
  - Fuel oil #6:

    AP-42 emission factors:
    - NOx – 55 lb/1000 gal
    - PM – 10 lb/1000 gal
    - SO_2 – 157S lb/1000 gal

  - Fuel Oil #2

    AP-42 emission factors
    - NOx – 20 lb/1000 gal
    - PM – 2 lb/1000 gal
    - SO_2 – 142S lb/1000 gal
- Emission factors for natural gas are from AP-42, Chapter 1.4 – Natural Gas Combustion, Table 1.4-1 and Table 1.4-2; note that sulfur content is unspecified in AP-42, therefore, assume 2000 grains/MMcf.
  - Natural Gas

    AP-42 emission factors
    - NOx – 100 lb/MMcf
    - PM – 1.9 lb/MMcf
    - SO_2 – 2000 grains/MMcf
- Fuel oil #6 heating content = 150 MMBtu/1000 gal (see AP-42, page 1.3-8)
- Fuel oil #2 heating content = 140 MMBtu/1000 gal (see AP-42, page 1.3-8)
- Natural gas heating content = 1035 Btu/cf
- Fuel oil #6 sulfur content = 2% by weight
- Fuel oil #2 sulfur content = 0.05% by weight

Convert Emission Factors to Energy Basis

Natural Gas

NOx:	(100 lb/MMcf)(1/1035 Btu/cf) =	0.0966 lb NOx/MMBtu
PM:	(1.9 lb/MMcf)(1/1035 Btu/cf) =	0.0018 lb PM/MMBtu
SO_2:	(2000 gr/MMcf)(1 lb/7000 gr)(1/1035 Btu/cf) =	0.0003 lb SO_2/MMBtu

Fuel Oil #6

NOx:	(55 lb/1000 gal)(1/150 MMBtu/1000 gal) =	0.3667 lb NOx/MMBtu
PM:	(10 lb/1000 gal)(1/150 MMBtu/1000 gal) =	0.0066 lb PM/MMBtu
SO_2:	(157 lb/1000gal)(2)(1/150 MMBtu/1000 gal) =	2.0933 lb SO_2/MMBtu

Fuel Oil #2

NOx:	(20 lb/1000 gal)(1/140 MMBtu/1000 gal) =	0.1429 lb NOx/MMBtu
PM:	(2 lb/1000 gal)(1/140 MMBtu/1000 gal) =	0.0143 lb PM/MMBtu
SO_2	(142 lb/1000 gal)(0.05)(1/140 MMBtu/1000 gal) =	0.0507 lb SO_2/MMBtu

Calculate Mexicali Weighted Basis Oil Emission Factor:

- Assume 50% of new fuel oil usage would utilize fuel oil #6 and 50% would utilize fuel oil #2, instead of historical ratios of 95% fuel oil #6 to 5% fuel oil #2:

NOx:	(0.50)(0.3667) + (0.50)(0.1429)	0.2548 lb NOx/MMBtu
PM:	(0.50)(0.0066) + (0.50)(0.0143)	0.0105 lb PM/MMBtu
SO_2:	(0.50)(2.0933) + (0.50)(0.0507)	1.0720 lb SO_2/MMBtu

Calculate Difference in Emissions Natural Gas Fired vs. Fuel Oil Fired

	Natural Gas	Fuel Oil	Difference
NOx:	0.0966 lb NOx/MMBtu	0.2548 lb NOx/MMBtu	2.64
PM:	0.0018 lb PM/MMBtu	0.0105 lb PM/MMBtu	6
SO_2:	0.0003 lb SO_2/MMBtu	1.0720 lb SO2/MMBtu	3573

Thus, assuming 50% fuel oil #6 firing and 50% fuel oil #2, fuel oil produces 2.6 times more NOx, 6 times more PM and 3500 time more SO2 emissions than natural gas.

Convert Emission Factors to Energy Basis

Natural Gas

NOx:	(100 lb/MMcf)(1/1035 Btu/cf) =	0.0966 lb NOx/MMBtu
PM:	(1.9 lb/MMcf)(1/1035 Btu/cf) =	0.0018 lb PM/MMBtu
SO_2:	(2000 gr/MMcf)(1 lb/7000 gr)(1/1035 Btu/cf) =	0.0003 lb SO_2/MMBtu

Fuel Oil #6

NOx:	(55 lb/1000 gal)(1/150 MMBtu/1000 gal) =	0.3667 lb NOx/MMBtu
PM:	(10 lb/1000 gal)(1/150 MMBtu/1000 gal) =	0.0066 lb PM/MMBtu
SO_2:	(157 lb/1000gal)(2)(1/150 MMBtu/1000 gal) =	2.0933 lb SO_2/MMBtu

Fuel Oil #2

NOx:	(20 lb/1000 gal)(1/140 MMBtu/1000 gal) =	0.1429 lb NOx/MMBtu
PM:	(2 lb/1000 gal)(1/140 MMBtu/1000 gal) =	0.0143 lb PM/MMBtu
SO_2	(142 lb/1000 gal)(0.05)(1/140 MMBtu/1000 gal) =	0.0507 lb SO_2/MMBtu

Calculate Mexicali Weighted Basis Oil Emission Factor

- Assume 50% of new fuel oil usage would utilize fuel oil #6 and 50% would utilize fuel oil #2, instead of historical ratios of 95% fuel oil #6 to 5% fuel oil #2:

NOx:	(0.50)(0.3667) + (0.50)(0.1429)	0.2548 lb NOx/MMBtu
PM:	(0.50)(0.0066) + (0.50)(0.0143)	0.0105 lb PM/MMBtu
SO_2:	(0.50)(2.0933) + (0.50)(0.0507)	1.0720 lb SO_2/MMBtu

Calculate Difference in Emissions Natural Gas Fired vs. Fuel Oil Fired

	Natural Gas	Fuel Oil	Difference
NOx:	0.0966 lb NOx/MMBtu	0.2548 lb NOx/MMBtu	2.64
PM:	0.0018 lb PM/MMBtu	0.0105 lb PM/MMBtu	6
SO_2:	0.0003 lb SO_2/MMBtu	1.0720 lb SO2/MMBtu	3573

Thus, assuming 50% fuel oil #6 firing and 50% fuel oil #2, fuel oil produces 2.6 times more NOx, 6 times more PM and 3500 time more SO2 emissions than natural gas.